King Air N2UW flight report for January 19, 2005
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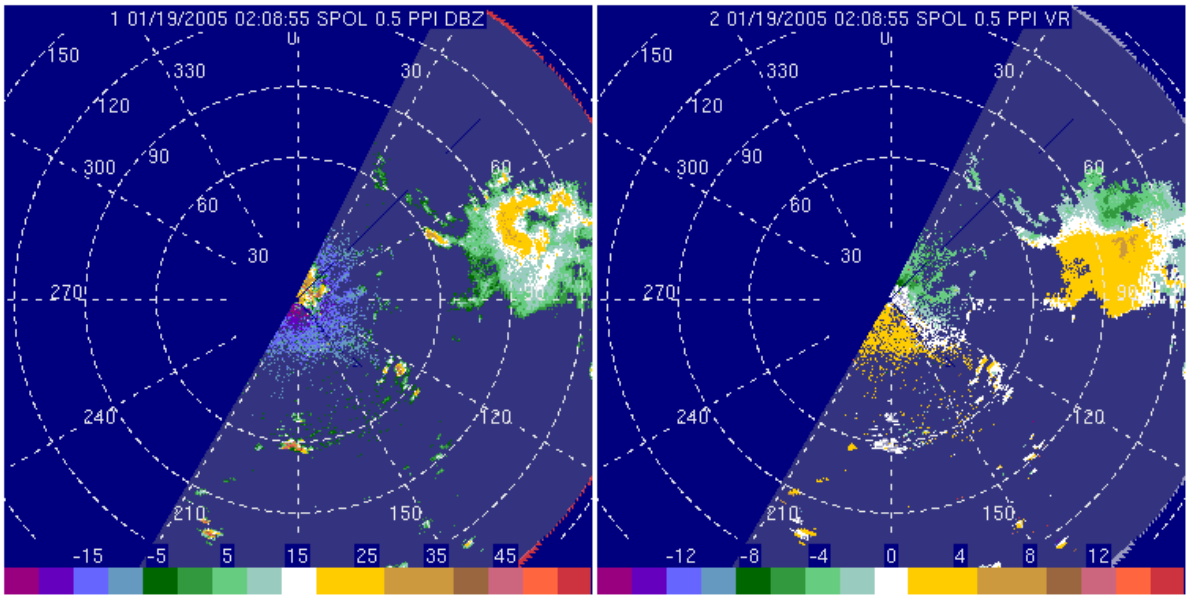
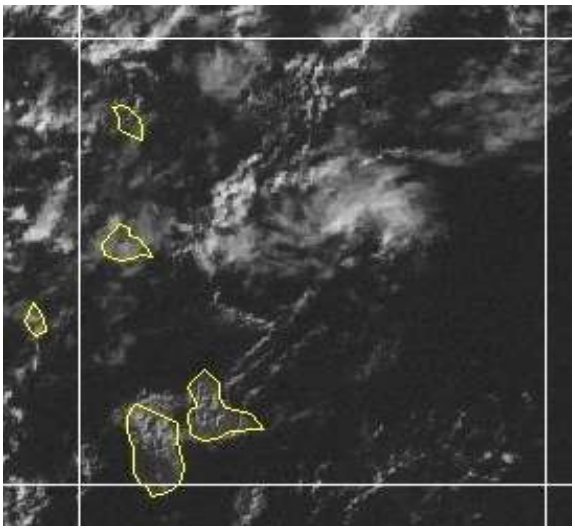
Summary:

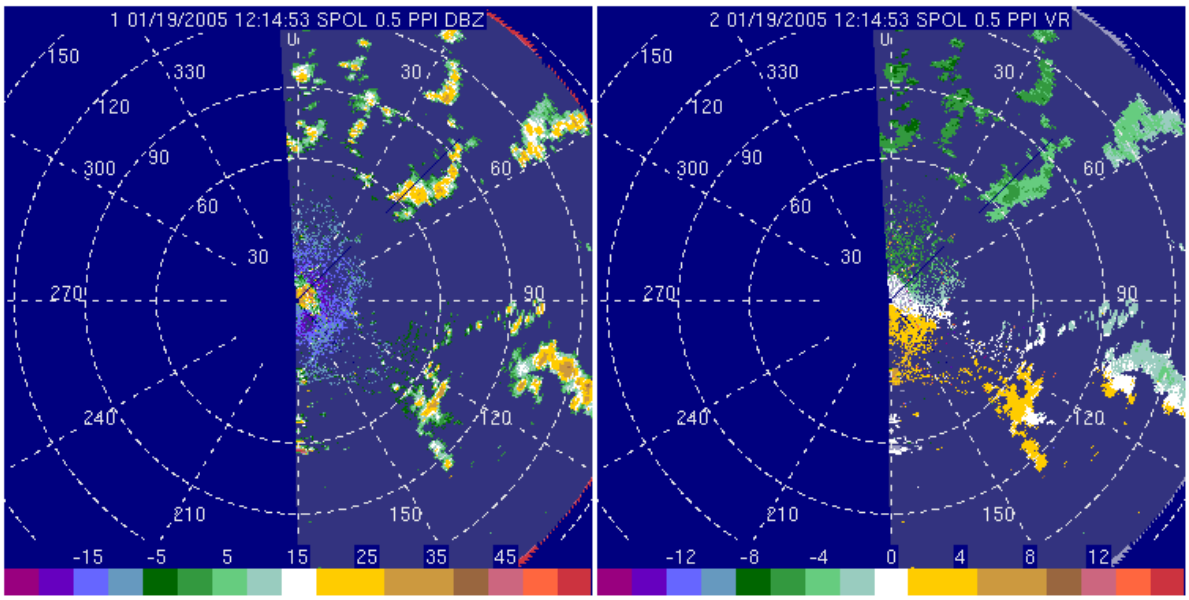
Deep *Cu*+ developed to E of Antigua and provided good targets for study of vertical structure and rain development. Most notably, the general area of this set of observations was the same as that of the afternoon of the previous day, both being located in the close vicinity of the **mini-cyclone** shown below in the VIS image at 12:15.

The first sign of this development was a large set of smaller echoes at about 20Z on Jan 18, located at 015°/100km from SPol. These echoes gradually merged and formed a solid echo patch and a convergence line around 22Z. The echo grew and became more circular in shape reaching 60 km diameter at its maximum development (01Z to 02Z on Jan 19). At that stage, rotation is clearly evident in both the reflectivity and Doppler data, as seen in the image below.



The storm moved very little and broke up by 05Z Jan 19. Small echo patches drifted toward the SSW and formed two separate regions with indications of cyclonic rotation. One of these (near 045°/70km from SPol) was sampled extensively between 12:10 and 12:30. This one is seen in the VIS image of 12:15 UTC and in the radar image below. First the S end of this group, later its N end were sampled. By about 16Z the echo pattern evolved into narrow wind-parallel lines.





Another notable element of the day's observations was the documentation of rain in and near vigorous updrafts.

Narrative:

Morning started with *As* illuminated by sun – lots of small vertical striations. Saw *Cu+* in the distant E. SPol reported scattered echoes. Still no wind, air felt less humid.

Started out at same time as C130, back-taxied together.

Headed E and picked up a *Cu+* at 8000' at much the same location that we sampled yesterday. Tried a few cloud tops and found them all soft. Sampled weakly precipitating cell at various altitudes.

Finally, in the same vicinity, picked a small, narrow, hard tower (barely big enough to fit the King Air in it). No impressive vertical velocity on the first penetration, but the cloud broadened and had 5+ m/s at 6000' later on. Followed this cell for an hour by stepping down, and with repeated penetrations at the selected altitudes to look at temporal changes apart from vertical variation. All this was done with the butterfly pattern, using the pointer, until the last few penetrations at low altitude, which were done with 90/270 turns, after an updraft/precip couple defined a direction. Significantly, on several passes, heaviest precipitation and strongest updraft were coincident or barely separated. This was also the case in the clouds sampled later on.

By the time the sequence just described was completed, the C130 finished the circle patterns and started sampling rain below cloud base in a sector defined by the 015-060 radials and 30-80 nm. Joined them in that area, with clearance of 5000' and above. Tried to coordinate location but that proved futile. Bob Rauber was using guidance from Eric at SPol. Found only weak precip at 5000' just N of SPol and in locations possibly approaching the volume viewed by RVSJ, so decided to climb to 8000' and look further NE. Found a cluster with some growth, in addition to older cloud mass going to maybe 12kft, at 023/68. SPol also reported this to be one end of an array (line) of possible targets. Made several penetrations at 8000', and 5500', including UD, SD and DD.

Flight notes:

1152	T/O ; no chat available. *As* at 4500' (ralt). Climbing to 12,000'
1203	at 12,000' +4C. Moving to cluster seen toward the SE.
1206	S heading, target selected; will do butterfly pattern with stepped descent
120839	photo over the right wing
121337	at pointer, dissipating cloud but still +ve vertical velocities
1217	at 6000'
121923	at pointer at 5000'; CPAS had to be restarted, few minutes of WCR data possibly lost
122150	4000' reset the pointer in updraft
122545	rain at pointer, 1600'; can see through it
1228	2304' (ralt); hunting for good cloud base with updraft - not much luck
1235	4000' N heading, target, pointer set
1239	new target seen but it is out of our area
1240	returning toward the pointer via a tall, disheveled cloud with protrusion to one side
124237	at pointer – nothing left
1246	doing roughly 270 turn to get on 135 heading, which appears to be orientation of line as judged by eye. The nose radar is unreliable. This at 4000', then climb.

1250 climb to 8000'
1257 target – small, hard looking, pointer set even though only 1 m/s found
1301 back to pointer using butterfly pattern
130210 target on right wing
130440 went for shoulder, reset pointer there in 4 m/s updraft
130540 passing other Cu
1307 8000'; finding 1-2 m/s updraft, descending
130820 photo right wing
1309 7000', 4 m/s updraft
[C130 taking 015-060, 30-60 sector]
1315 5500' (ralt) 5 m/s up
131940 red NRE (nose radar echo)
1322 4 m/s up, rain at the same time; doing this by pointer in butterfly pattern
1326 red NRE, 2 nm from pointer, then 8 m/s updraft; changing to 90/270 pattern
1329 7 m/s up, 4 m/s down and rain on E-bound leg
133332 at pointer; just past it find 11 m/s up and heavy rain
[to the NW of the sampled cloud it is clear of smaller clouds]
1339 rain in/near 5 m/s updraft, 3 mm drops, strong attenuation; another 90/270 and descent
1341 change to SD mode at pointer, 3700' (ralt)
134620 1700' (ralt), just about cloud base
135010 photo of large dome with little shelf cloud on one side
135158 target – has rain; 568' (ralt)
1356 end of 560' run at limit of clearance; climb to 6000', new clearance arranged in coordination with the C130 (it has 010-060, 30-80 nm, 3000' and below) while it is sampling rainshafts.
1400 climb, roughly at pointer, clear air; cloud to left
1405 large clear area between area we sampled and Barbuda; N of Barbuda large cloud mass
1415 6300' (ralt); looking for opportunity with SJ
1419 – 1427 chasing NRE vicinity 010/38 – not much interest
1429 climb to 8000' heading 020
1437 WCR has been SD, now UD
1438 023/70 target, 1 mm drops at 8000'; pointer set
1447 back the third time; SD
1452 back at pointer, DD, to side of NRE no its center
1454 descend and return with DD
145546 photo of adjacent cell to S; followed by photo of time display

145710 lined up on target; 5400' (ralt), DD
red NRE to left by 2 km
1500 rain to surface; smooth run – good for DD
1503 UD, 180 turn to what was red NRE, but it is weaker by the time it is traversed
1508 moving further S
1513 tower with pileus, 5 m/s up; pointer set; 90/270
1519 back
1523 1 km offset added to pointer; 5000'; SD mode
152702 at offset pointer; bumpy - end of study
1542 L/D